REMARKS

I. Introduction

With the cancellation herein without prejudice of claim 35, claims 15 to 25, 27 to 34 and 36 to 54 are pending in the present application. In view of the foregoing amendments and the following remarks, it is respectfully submitted that all of the presently pending claims are allowable, and reconsideration is respectfully requested.

II. Allowed Claims 25 and 36 to 54

Applicants note with appreciation the indication that claims 25 and 36 to 54 are allowed.

III. Objections to Claim 35

Claim 35 was objected as being a substantial duplicate of claim 36. Claim 35 has been canceled herein without prejudice. Accordingly, it is respectfully submitted that this objection is now moot.

IV. Rejections of Claims 15 to 24 and 26 to 34 Under 35 U.S.C. § 102(b)

Claims 15, 17 to 24 and 26 to 34 were rejected under 35 U.S.C. § 102(b) as anticipated by Japanese Published Patent Application No. 09-232738 ("So et al."). Claims 15 to 17, 20 to 23, 28, 29 and 32 to 34 were rejected under 35 U.S.C. § 102(b) as anticipated by Japanese Published Patent Application No. 06-342770 ("Yoshie et al."). Applicants respectfully submit that neither So et al. nor Yoshie et al. anticipates the present claims for the following reasons.

Claim 15 relates to a method for etching a pattern in an etching body in accordance with a plasma, in which a high-frequency-pulsed high-frequency power is coupled into the etching body, via an at least temporarily applied high-frequency a.c. voltage, and modulated at low frequency. Claim 15 recites that a mark-to-space ratio of the coupled, high-frequency-pulsed high-frequency power is between 1:2 and 1:100.

So et al. and Yoshie et al. relate to so-called diode reactors, i.e., parallel plate reactors, where **one** electrode, that is, the substrate electrode on which the wafer lies, is supplied with high frequency to generate both the plasma and the ion-acceleration voltage simultaneously. In this regard, So et al. and Yoshie et al. pursue a pulse strategy of attempting to increase the maximum ion-acceleration voltage without excessively reducing the average plasma density. Accordingly, the processes disclosed in So et al. and Yoshie et

al. require high mark-to-space ratios of greater than 1:1, such as, for example, ratios corresponding to a duty cycle of 50%, 67%, or 80%. Indeed, as the pause time is increased, the efficiency of the processes disclosed in So et al. and Yoshie et al. suffer, despite an attempted increase in pulse density during the pulse phase via the increased ion-acceleration voltage, since plasma is not produce during the pause times. Hence, the processes disclosed by So et al. and Yoshie et al. rely on a high sputtering effect, that is, the incidence of ions on the wafer having as large a physical effect as possible, such as may be used for oxide coatings, or they rely on higher anisotropy of the etching where the process is markedly induced by ions.

In stark contrast thereto, the subject matter of the claims of the present application relate to a high-density plasma system, in which the plasma generation (via an inductive plasma source) and the ion acceleration (via the high-frequency power applied to the substrate electrode) towards the wafer occur separately from each other and independently. In the plasma, the inductive source produces, *inter alia*, ions, which are accelerated in the direction of the wafer to a desired energy by the high frequency electrode. Hence, unlike So et al. and Yoshie et al., the present application involves a notch-resistant pulse technique to suppress the formation of pockets in response to stopping the etching on dielectric interfaces, whereby the process window is configured to be maintained as wide as possible for the actual silicon etching. Accordingly, the claims of the present application as compared to So et al. and Yoshie et al. are directed to entirely different subject matter.

The Office Action asserts on page 3 that Figure 2c of So et al. shows a "mark-to-space ratio" of 4:14. However, it is respectfully submitted that Figure 2c of So et al., in particular, example 2, shows a 1:1 "mark-to-space ratio" of 1:1 and that a "mark-to-space ratio" of 4:14 is only obtained by setting the pulse duration in the ratio to an overall T3+T4 cycle, T3 being the on-time duration and T4 the off-time duration of a second, low frequency modulation. It is respectfully submitted that this calculation is not relevant, since the "mark-to-space ratio" of the high frequency pulsed high frequency power is determined by the ratio T1:T2, which yields exactly 1:1, as in example 2. By contrast, T3 or even T4, that is the pause duration of the low frequency pulsing, is not important. In this regard, it is respectfully noted that the present application discussed the pulse to pause ratio of the high frequency power with respect to Figure 1b, and it may be seen from Figure 1b, which shows only a part of Figure 1a in detail, namely, pulse range 50 from Figure 1a, that the pause duration 51 of the low frequency modulation from Figure 1a is not important for the calculation of the "mark-to-space ratio" of the high frequency pulsed high frequency power.

It is also respectfully submitted that the different value range for the pulse-to-pause ratio of the high frequency pulsed high frequency power between the present application and So et al. or Yoshie et al. results from fundamentally different etching methods. As discussed above, So et al. and Yoshie et al. refer without exception to so-called diode reactors, that is, parallel plate reactors, in which one electrode (in the cases given, the substrate electrode on which the wafer rests) is supplied with high frequency, so as to generate thereby, at the same time, both the plasma and the ion acceleration voltage. The given pulse strategy pursues the aim of increasing the maximum ion acceleration voltage without, thereby, excessively reducing the average plasma density: that means high mark-to-space ratios of >1:1, for instance, a duty cycle of 50% or 80% or 67%. For, in the pauses, no plasma is produced, and if the pauses become too long, then, indeed, plasma is not on for too long a time, and process efficiency suffers, although in the pulse pauses themselves, the plasma density is higher than in the normal case, and the ion acceleration voltage to the electrode is clearly higher than in the normal case. Here, the intention is for as large as possible a physical effect of the incidence of ions on the wafer, that is, a high sputter effect, for instance, for oxide films, or a higher anisotropy of etching in strongly ion-induced processes. The production of plasma and ion acceleration are always coupled to each other.

The present application, by contrast, refers to highly dense plasma equipment in which the production of plasma (via an inductive plasma source) and the ion acceleration (via a substrate electrode having high frequency power applied to it) to the wafer occur separately from each other and independently. In the plasma, because of the inductive source, among other things, ions are produced which are accelerated to the desired energy towards the wafer by the high frequency at the substrate electrode. Here, the pulsing technology is intended to suppress notching, i.e. the formation of pockets at the etching stop on dielectric interfaces, for the actual silicon etching, so as to maintain as wide as possible a process window. Therefore, So et al. and Yoshie et al. are not comparable to the present application since they pursue a different aim, and also a different strategy.

To anticipate a claim, each and every element as set forth in the claim must be found in a single prior art reference. Verdegaal Bros. v. Union Oil Co. of Calif., 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987). Furthermore, "[t]he identical invention must be shown in as complete detail as is contained in the . . . claim." Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989). That is, the prior art must describe the elements arranged as required by the claims. In re Bond, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). As more fully set forth above, it is respectfully

submitted that So et al. and Yoshie et al. do not describe, or even suggest, a method of etching a pattern in an etching body, in which a mark-to-space ratio of a high-frequency-pulsed high-frequency power coupled into the etching body is between 1:2 and 1:100. It is therefore respectfully submitted that neither So et al. nor Yoshie et al. anticipates claim 15.

As regards claims 16 to 25 and 27 to 34, which ultimately depend from claim 15 and therefore include all of the limitation of claim 15, it is respectfully submitted that neither So et al. nor Yoshie et al. anticipates these dependent claims for at least the same reasons given above in support of the patentability of claim 15.

In summary, it is respectfully submitted that neither So et al. nor Yoshie et al. anticipates claims 15 to 25 and 27 to 34. Withdrawal of this rejection is therefore respectfully requested.

V. Conclusion

It is therefore respectfully submitted that all of the presently pending claims are allowable. All issues raised by the Examiner having been addressed, an early and favorable action on the merits is earnestly solicited.

Respectfully submitted,

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